



Making Waves: Radio Spectrum a Vital Resource for Mission Success

By Zaid Yacu and Thomas Kidd - April-June 2013

We live in a radiant world. Natural cosmic and manmade radio waves flood the atmosphere around the world on a daily basis. These invisible and quiet waves are an important and integral part of our lives. Most people are heavily dependent on them to communicate with others, access electronic devices, and operate remote-controlled technology.

The entire electromagnetic spectrum cannot be seen by the human eye — only visible light is detectable. An electromagnetic field is generated when an alternating current is input into an antenna. Created by vibration or oscillating electric and magnetic fields, electromagnetic radiation consists of a stream of photons traveling silently in the form of waves moving at the speed of light. The electromagnetic spectrum cannot be heard. A wave is called electromagnetic because it is made up of two parts: an electric field and a magnetic field.

The only difference between the various types of electromagnetic radiation is the amount of energy generated. Radio waves have photons with low energies, microwaves have a little more energy than radio waves, and infrared light has still more energy. Moving up in energy level is visible light, ultraviolet light, X-rays, and the most energetic of all, gamma rays. The higher the radio wave frequency, the shorter its wavelength and the greater its energy.

As energies travel, they produce a unique wavelength with a frequency that can be identified and measured. Frequency is measured in hertz while wavelength is measured in meters. A wavelength is the distance from crest to crest between two peaks of a wave. A frequency is the time interval between passing peaks. The greater the length of the wave, the lower its frequency and energy will be. The shorter the wave, the higher the frequency and energy will be.

Radio waves have the longest wavelengths in the electromagnetic spectrum. These waves can be longer than a football field. The longest waves are several kilometers in length. The shortest radio waves are millimeters long while gamma rays measure less than the diameter of an atom. The radio frequency (RF) spectrum has several unique properties.

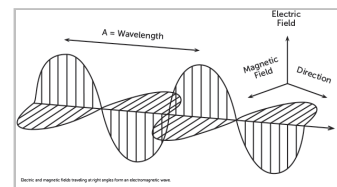
- It is free; it does not cost anything to use it.
- It is finite; there is a great deal of competition and demand for it.
- It is not consumed or destroyed when used.
- It is wasted when it is not being used.

RF spectrum is a vital and limited national resource, and the U.S. federal government makes extensive use of it for electronic communications and transferring data and information.

The use of the RF spectrum is regulated. Access is controlled and rules for its use are enforced because of the possibilities of interference between uncoordinated uses. Managing the RF spectrum can be a great challenge. Internationally, it is allocated by the International Telecommunication Union (ITU) to various classes of service according to different regions of the world. Within the United States, the RF spectrum is further allocated between nonfederal government and federal government users.

The Federal Communications Commission (FCC), acting under the authority of Congress, is responsible for the allocation and assignment of frequencies to nonfederal government, civil and commercial users, as well as state and local government agencies. The FCC decides who is able to use specific frequencies for specific purposes, and it issues licenses to stations for specific frequencies.

The National Telecommunications and Information Administration (NTIA), which is an operating unit of the Department of Commerce and an Executive Branch agency that is principally responsible for advising the president on telecommunications and information policy issues, administers the allocation and assignment of frequencies to departments and agencies of the federal government such as the Department of the Navy, Federal Aviation Administration and the Federal Bureau of Investigation.



Electric and magnetic fields traveling at right angles form an electromagnetic wave.

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Coordination between nongovernment and government users of the RF spectrum is accomplished by joint meetings of the FCC and the NTIA. The NTIA is also responsible for maintaining the National Table of Frequency Allocations. The NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management is the guidebook for frequency authorization in the United States, its possessions and territories.

The use and access of the radio spectrum are fundamental to the government, military and warfighter to accomplish core missions across all functional and operational areas. The military is heavily dependent on the RF spectrum to communicate essential and urgent information and data instantaneously.

The government and military are required to manage the spectrum by planning, coordinating and managing the use of the RF spectrum through operational engineering and administrative procedures, policies, standards and directives. The objective is to enable spectrum-dependent equipment and capabilities to perform their functions in the intended electromagnetic operational environment while avoiding harmful RF interference.

The future role of the United States as a superpower and its assured victory in conflicts are dependent on how it makes use of the electromagnetic spectrum, and how it commands and controls this valuable, finite, congested and contested natural resource.

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